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## A STUDY OF NESTING WOOD DUCKS IN IOWA

By FREDERIC LEOPOLD

This article concerns the nesting habits of the Wood Duck (*Aix sponsa*), including nest site selection, egg laying, incubation, hatching, departure from the nest, and travel of the brood to water. The material is taken from notes covering over 2500 nesting box checks plus many hours of watching from a portable blind or other vantage point, in the course of 12 years, beginning in 1939. At that time the Illinois Natural History Survey furnished 50 Wood Duck boxes to the Crystal Lake Club near Burlington, Iowa, on the Mississippi River bottoms. For four years I helped make semiannual inspections of these boxes. Ducks used only a small percentage and few were successful due to predation by raccoons and other animals.

In 1943 three boxes were moved to my yard, where a single pair of Wood Ducks had been seen prospecting for a nesting site. To my surprise and delight, each of the three boxes was used by the ducks and successful hatches resulted in each case. Subsequently, the project at my home was expanded by hanging additional boxes. In recent years the nesting colony has grown to include 10 to 12 pairs, as shown in table 1.

Table 1

The Growth of the Nesting Colony from 1943 to 1950

Year	Number of nests	Number of available nest sites
1943	3	3
1944	5	8
1945	9	14
1946	6	14
1947	8	14
1948	12	15
1949	10	15
1950	11	17

—  
64 total

The study area is within the city limits of Burlington, extending one city block along the bluffs overlooking the Mississippi River, which at this point is half a mile wide. The bluffs are about 130 feet high and very steep, in part precipitous. They are overgrown with brush and wild grape. Along the foot of the bluffs runs a single track railroad, the fill of which pitches directly into the river except at low water stages. All broods must descend the bluff and cross the tracks to reach the river. The yard where the boxes are located extends for a block back from the edge of the bluff. Our trees are large, being a mixture of hardwoods, larch, spruce and pine, most of them planted about 70 years ago.

Across the river in Illinois are broad bottoms with timber, lakes and sloughs. This

is the feeding, mating and resting ground of the breeding ducks, as well as the rearing area for most of the broods.

Throughout the eight seasons of my backyard Wood Duck observation, I have made it a point to keep the study on as nearly a natural basis as practical. When an oversized clutch of eggs was laid, I could have transferred eggs from nest to nest and thereby increased production but I have refrained from such interference. However, when squirrels have used the boxes, I have removed their nests because often they com-

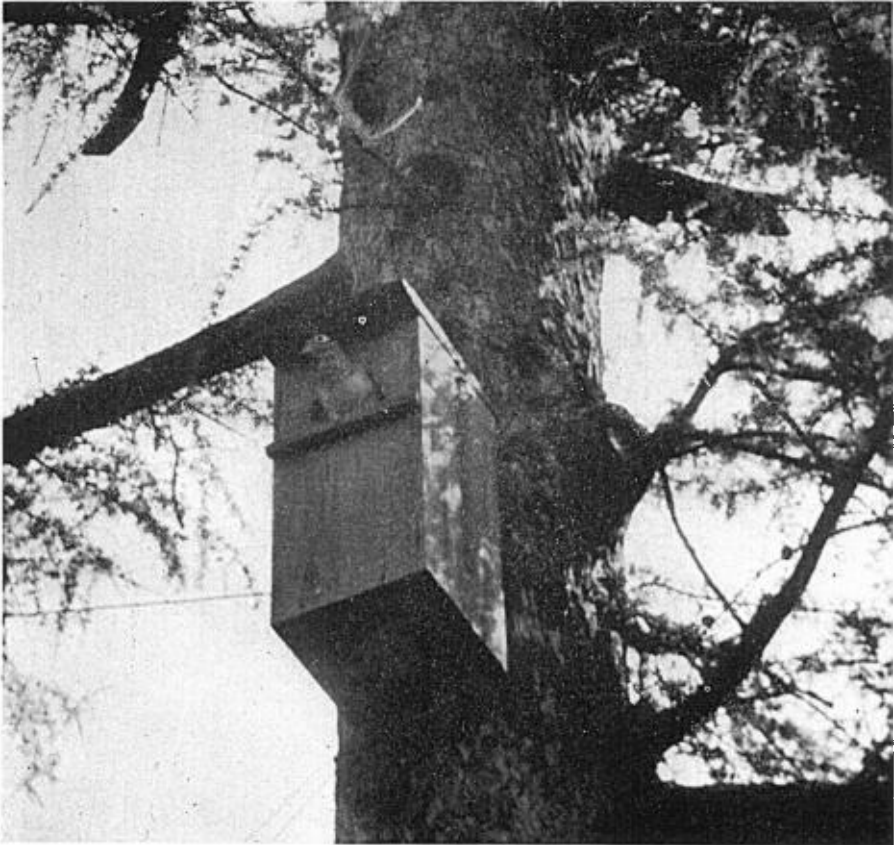


Fig. 1. Female Wood Duck in the entrance hole of nest box.

pletely filled the box. Gray squirrels in considerable numbers live in the neighborhood, but for reasons unknown to me, they have destroyed no duck nests. Other predators are either absent or unimportant. Neither raccoons nor opossums frequent the area. Barred Owls sometime spend winter days in the evergreens where they are well hidden. Screech Owls use the boxes in winter as roosts and occasionally for nesting. Snakes are rare and make no trouble. A flicker once nested in a duck box, and in 1948 flickers broke a few eggs in one nest. In short, nest predation is slight in my area as compared to wild conditions where a high percentage of duck nests normally are destroyed. This factor, I believe, accounts in part for the fairly steady increase in the nesting colony studied.

## METHODS

*Nest boxes.*—All the boxes used were copied from the design used by the Illinois Natural History Survey. The material is rough, one-inch lumber. Outside dimensions are 12 by 12 inches with a height of 24 inches. The lid is flush at back and sides but projects about two inches at the front. It is held in place by two screen door hooks plus an inner lid which fits loosely into the inside of the box. The entrance hole, four inches in diameter, is located four inches below the lid (fig. 1).

The box is attached to the tree by means of a hanger bolt which is first screwed into the tree. This bolt passes through a hole in the back of the box located opposite the entrance hole. A large iron washer plus a heavy wing nut on the end of the hanger bolt provide a rigid fastening when tightly drawn. On a fast growing tree the wing nut can be loosened a few turns after a year or two if the washer is biting into the back of the box.

One refinement has been added to the original box. I have nailed small wooden cleats at either side of the entrance. The upper half of each cleat is slightly tapered away on the inner face so that a fine strand of vegetation about 10 inches long can be wedged between the cleats and the face of the box. This strand, which is made of the inner bark of basswood shredded into fine pliable fibers, passes across the center of the entrance hole. One end of the strand is wedged tightly behind its cleat, the other end laid loosely behind the other cleat. In this way the "gate" does not interfere with the passage of the bird and remains available for repeated use. The closed position shows that no duck has passed, while the open position indicates that the box should be inspected and the "gate" reset.

During egg laying and incubation this device is useful in securing information with a minimum of disturbance to the duck. Records which might require hours of watching, and which it would be impractical to get where a good many nests are being followed at one time, can be secured by observing the open or closed condition of the "gate." The device, of course, is useless except when making frequent inspections, particularly on active nesting boxes.

Most nesting boxes are hung so that they are in easy reach with a 16-foot ladder. This appears to be high enough to satisfy the ducks.

A minimum of four inches of decayed vegetation from my compost pile is placed in the bottom of the box so that the ducks can bury their eggs and later form their nests. Leaf litter will also do but coarse sticks should not be included. The ducks carry no nesting materials.

## ARRIVAL OF THE DUCKS

The arrival of the Wood Ducks at the nesting site varies with the weather from year to year. The first ducks usually are observed in my yard from March 15 to April 1, with the last few days of March the most frequent time. Wood Ducks are seen in the swamps across the river several days to a week prior to their appearance in the nesting area.

When the ducks prepare to nest, the pairs are seen sitting in the leafless trees near the boxes during the first half of the morning. They sometimes stay in one tree for a considerable period, either quite motionless or walking slowly along a larger limb in a rather awkward, pigeon-toed manner. In spite of their size, they are difficult to see even in the bare trees where they blend with crooked limbs or other irregularities.

The hens investigate the nesting boxes but spend more time on the tree limbs than inside the boxes. If not too frequently flushed, they may eventually nest. The first evidence of occupancy is a cup-shaped depression in the litter. A single female may try several boxes in this manner before choosing one to be used for her nest.

Strange sites are sometimes investigated by the ducks in their quest of a suitable nesting spot. One pair repeatedly sat on the top of an unused chimney peering down the flue. In another case a neighbor found a dead female above the damper in his fireplace flue. I observed no signs of territorial disputes between pairs.

#### THE EGG LAYING PERIOD

As soon as the hen starts laying, the cup-shaped depression disappears, for the early eggs are covered with litter. This often results in a low pyramid near the center of the box completely covering the eggs.

Eggs usually are laid during the hour or two following sunrise. The members of a pair come together to the nest area. They may both sit in nearby trees for a time, or the hen may go directly into the nest, while the male waits a short distance away. While waiting, the male sometimes makes a very quiet call which is similar to the male goldfinch "sv-ee-ee-t" call. This is repeated several times. To hear this call the observer must be very close. I first noted it while watching with binoculars, with the aid of which I could see his bill open and slowly close again.

Table 2  
Dates of Appearance of First Eggs in 61 Nests

Period	1943	1944	1945	1946	1947	1948	1949	1950	Total
March 23-31	—	—	2	2	—	—	2	1	7
April 1-15	—	2	—	2	4	6	5	4	23
April 16-30	3	1	2	1	—	1	1	1	10
May 1-15	—	1	—	1	2	4	1	3	12
May 16-31	—	1	2	—	2	—	1	1	7
June 1-20	—	—	1	—	—	—	—	1	2
									—
									61

During the early part of the egg laying period, the time spent in depositing the egg is sometimes as short as five minutes. Considering the fact that the new egg must be covered, this is certainly expeditious. On emerging from the hole the hen usually flies away, followed by her drake, not to return until next day. Toward the end of egg laying the hen spends considerable time in the box.

The normal rate of laying is one egg per day, although occasionally a day will be passed without a new egg. Only 13 days were skipped in the laying of 297 eggs, which gives an average of .96 eggs per day. Most clutches are completed without deviating from the egg per day schedule.

Omitting dump nests in which two or more hens have layed, the average clutch proved to be about 11.8 eggs. Early clutches, initiated in late March or in April, were larger (13.9 eggs) than May clutches (11.0 eggs). The latter group doubtless included some second nesting attempts, and it is well known that among many game birds second clutches tend to be small. The data in table 3 include dump nests, thereby accounting for the large average size of clutch (14 eggs).

Plucking of down, which serves to keep the eggs warm during incubation, starts with the fourth to as late as the tenth egg. In 70 per cent of the nests the first down appeared with the sixth to the eighth egg. The rate of down accumulation is on an ascending scale. The first day that down is found there may be only a very small amount such as could be held in a dessert spoon. The amount added increases daily until, during the three or

four days immediately before incubation, 50 or more cubic inches may be added in the course of a 24-hour period.

Most first nests contain about 200 cubic inches of down by the end of the egg laying activities. In an early nesting, the down will be nearly pure, containing practically no breast feathers. In the case of a renesting bird, there is a reduction in the volume of down, often dropping below 100 cubic inches and in one case, down to only 25 cubic inches. Many breast feathers may be mixed with the down.

#### DUMP NESTS

Dump nests are identified by several criteria: (1) Eggs are left uncovered; (2) several eggs may be laid on the same day; (3) normal down is missing unless one or more hens adopt the nest as their own and proceed to incubate; (4) clutches are abnormally large and often are unsuccessful in hatching.

I believe some dump nests result when nests of birds in the egg-laying phase are destroyed. The hen, having a supply of eggs in process of development, needs a place to lay. Therefore, she uses any convenient nest and after dumping a few eggs may select a new site and proceed to lay a clutch in a normal way.

I observed one dump nest in 1948 that received four eggs on April 30, two on May 1, one on May 2, one on May 3 and none thereafter. Coincidentally, I had new nests receiving their first eggs on May 1, 2, and 4, respectively. Probably three of the four ducks laying in the dump nest on April 30 subsequently started individual nests of their own.

#### INCUBATION

Some females spend four or even more nights in the nest before the clutch is completed. Until the season of 1947, I went on the assumption that when I saw a hen enter her nest in the late evening, and, on checking my "gate" by flashlight later in the night, found her still on the nest, she was starting to incubate her eggs. The fact that later checks showed eggs had been added since her first night in the nest confused me, but I presumed that an outside bird had dropped the additional eggs while the hen was off on her rest flights.

In 1948 I found that the eggs that had been added probably were laid by the occupant and that more often than not she would stay off the nest through the day and therefore obviously was not incubating. I checked this theory by candling eggs from each of several nests where the female had spent the night on the nest and the following day off. No development was visible in the eggs even after four such successive nights. However, as soon as the eggs had been kept warm for a full day and night, the egg development was immediately noticeable. Therefore, I feel that the period of incubation does not start until all eggs have been laid and until the hen is ready to keep them warm for a 24-hour period. Incubation would conclude its first full day on the morning subsequent to the appearance of the last egg, except for an occasional hen that may take one or more days off after depositing her last egg before starting to incubate.

The relative position of eggs in the clutch changes constantly. By marking each egg that lay on the perimeter of the clutch, I found that in one-half day, two or more of the outer eggs in the group would be replaced by unmarked eggs, indicating not only a rolling of the eggs but an actual trading of positions. This explains why abnormally large clutches, usually laid by several ducks, may not hatch well, for as eggs take their places on the outer edges there is insufficient warmth and the embryo may die. As many as twenty eggs may be incubated successfully by a single hen (table 3), but in such large clutches the percentage of success is usually low.

*Routine of the female.*—The normal behavior of the duck during incubation is to leave the nest for feeding, water and relief twice daily, in the early morning and late afternoon. The direction of flight on leaving is substantially uniform for a given bird, possibly because she seeks her mate in the same general area each time she leaves. The hen may give her screaming cry after she has flown several hundred yards from her nest, presumably in an effort to communicate with her mate.

Incubating hens usually move out on their morning rest flight very early and return to the nest before laying hens reach the nesting area. This is not universal but it is general practice and may account in part for the fact that few eggs are dropped into nests

Table 3  
Summary of Data on 63 Nests

Size of clutch	Number of nests	Total eggs	Eggs hatched	Eggs infertile	*Other egg losses
7	1	7	6	1	—
9	4	36	25	8	3
10	6	60	57	1	2
11	10	110	99	5	6
12	7	84	68	3	13
13	8	104	89	3	12
14	7	98	90	6	2
15	4	60	50	2	8
16	4	64	52	4	8
17	2	34	30	—	4
18	2	36	35	—	1
19	1	19	19	—	—
20	2	40	39	—	1
21	2	42	—	?	42
24	1	24	20	—	4
25	2	50	10	3	31
Totals	63	868	695	36	135
Percentages		100	80	4	16

\*Other losses are composed largely of eggs wasted in dump nests plus a smaller number of eggs laid by outside females after the balance of the clutch is in incubation.

of incubating hens by outsiders. Morning rest flight often starts as early as an hour before sunrise when there is just a faint sign of dawn in the east. On the evening flight the hen usually departs between five and six o'clock and returns before seven.

Duration of rest flights varies from forty minutes to two hours with slightly over an hour a fair average. Before leaving, the down is spread evenly over the eggs.

The custom of two rest flights per day is not always followed. Sometimes a duck may, for a number of days, take only one rest period per day. This may be either in the morning or evening and the same bird may switch from only morning flights to only evening flights or to two rests per day.

Inspections during incubation should, so far as practicable, be made during the time of the rest flights. However, no serious interference is caused even though the hen happens to be at home. Individuals react differently when the inspection is made. The mere placing of the ladder will flush some hens. Others, on having the lid raised slightly, will crane the head up toward the intruder and, opening their bills wide, utter threatening hisses. Others hold their heads low and "freeze." Any one female is apt to be quite constant in her reaction to an inspection. I have had only one nest deserted on account of my inspection.

The down is usually sufficient to cover all the eggs to a thickness of from one and one-half to two inches, and can be raised without breaking apart, by lifting carefully from one edge. The insulating value must be substantial in order to keep the eggs warm during the hen's absence. When the hen is on the nest, the down forms a border around the eggs so that the heat is retained around the edges.

Despite long continuous periods on the eggs, the nest is seldom dirtied, and then usually as a result of frightening or flushing the hen from the nest.

*Attention of drakes to incubating hens.*—When returning to the nest the incubating hen is followed in flight by her drake. She usually flies directly to her hole and immediately enters, in fact, she brakes so close to the box that it is surprising she can stop in time. No calls are made by either bird when approaching the nest. The drake usually follows until close to the nest but at times will leave her at quite a distance. Infrequently he may perch nearby momentarily, or even for five or ten minutes, before leaving. The beauty of the flashing drake as he swings by, having escorted his lady home, is a charming memory for a winter evening.

The attendance of the drake does not usually continue throughout the incubation period. Generally, during first nestings (April and May), the drake attends the hen and returns to the nest with her until the fourth week of incubation. Among ten pairs kept under close observation throughout incubation, seven drakes abandoned the hens in the fourth week (22 to 28 days) and two others probably did likewise. However, I have one record of a drake which flew in from a nearby tree, where he had been sitting unseen, and alighted on the lid of the nesting box while the ducklings were jumping out, the hen being on the ground at the base of the tree. He drove away a curious Blue Jay from a branch a few feet from the nest box. This drake was probably parent to the brood, for the hour being mid-morning, no other drake would ordinarily have been about.

The breaking off of attendance on the hen by the drake near the end of incubation may be due to the fact that the hen no longer seeks her drake while off resting, or perhaps to a loss of interest on the part of the drake. In late nests, during June or July, the drake may abandon the hen immediately after egg laying has been completed. I have never seen the drake incubate the eggs. In fact, I have never seen the drake enter the nesting box at any time.

*Duration of incubation.*—As the hatching date approaches, an examination of the eggs by ear detects the first sign of life in the form of a watery gurgle, or sticky sound, as the duckling moves within. A day or two later peeping is heard. From the time the first crack or pip is visible it takes two days for the duckling to release itself.

Using the date on which the last egg was laid, or the first full day on the nest, whichever was later, as the beginning of incubation on 35 nests on which I have good data, I obtained the spread in incubation period shown in table 4. It is evident that there is substantial variation in time required to complete incubation, well over half of these nests deviating from the mean period of 30 days. Factors which may contribute to this variation are: (1) number of daily rest flights by the hen; (2) duration of rest flights; or (3) amount of down available to protect the eggs during rest flights.

The duck evidently has no automatic release which prevents her from continuing to incubate eggs which are no longer alive. In 1947 I had one nest of 21 eggs in a natural cavity where the eggs had too much room to spread out and, as a result, the embryos all died rather early. This duck started incubation on April 15 and continued until June 16, a total of 62 days. Upon examination at that time I detected a very bad odor, not noticed previously, resulting from the breaking of one or more of the rotten eggs.

At the time, I considered that the odor from a broken, decayed egg might have caused

the hen to quit the nest, but an experience in 1949 indicates that sense of smell must be unimportant to a Wood Duck. In this case, during the laying period, one egg had been added each day for the first five days. For the next five days, two eggs were added each day, making 15 eggs. Two additional eggs were then added a day or two later. Incubation began on April 24. Nest checks were made on April 25, 26, 27, 28 and 29 with nothing unusual noted. On May 17 the box was inspected and the hen found on the nest when the box lid was slightly raised. My notes state: "Very bad smell in nest, hen active." On May 19 another inspection, made while the incubating hen was absent, disclosed a dead female on one side of the nest. The carcass was very light weight, with

Table 4  
Observed Periods of Incubation in 35 Wood Duck Nests

Days required to incubate	Number of nests
27	1
28	6
29	5
30	13
31	6
32	3
33	1

practically all the flesh and intestines gone. There were five eggs under the dead bird, all of which adhered to the carcass as I removed it. The remaining 12 eggs were warm. Eleven of them hatched on May 26. So the successful incubating hen must have attended the eggs regularly during the time that the dead bird was decaying by her side.

Another odd experience concerns a hen incubating a clutch of nine eggs. This hen started incubation on May 4, 1945. On May 31 I discovered she had an open hole in her upper mandible about two-thirds of an inch from the tip, the size being one-quarter inch long by three-sixteenths inch wide. The bird's tongue was plainly visible through the hole. The edges of the wound were white but no odor was detected. On June 3, four eggs were hatched. There was no clue to indicate what may have caused the injury nor do I know when it occurred. The urge to bring off her brood was strong enough to keep this crippled bird at her incubating duties until the eggs hatched even though she must have had considerable trouble in feeding herself.

#### HATCHING

I believe the period between emergence of the first and last ducklings from the shell is probably not longer than four to six hours. The mother seldom leaves during this time or, indeed, until the ducklings are dry and active. The discarded shells are very brittle and disintegrate rapidly into small particles. The tough membrane within the shell separates into two nearly equal halves. These membranes enable one to count the number of ducklings hatched in the brood even though the number of eggs had not been known previously. No broken shells or membranes are removed from the nest by the mother.

The down in the nest box is much reduced in volume as the hatch progresses, being solidified by contact with the wet ducklings and membranes.

An inspection made while the hen is on her brood frequently discloses several perky little heads peeking out from under the mother. These ducklings are always quiet, never peeping or moving, while being inspected. If the mother is off, the first impression is of



an empty nest. All ducklings are "frozen" on the floor, forming a solid black-brown mat. The lighter belly and cheek markings are hidden completely, the heads being tucked under or between other members of the brood. In watching for several minutes under these conditions not a flicker of movement can be seen. Stirring the ducklings only makes them cling tighter to the nest floor.

Newly hatched ducklings may be lost in a variety of ways, as I found, to my great regret, several years back. In one nest, five healthy ducklings were deserted because they had not been able to climb to the hole, since the lumber from which I had built several new boxes was not rough enough to give them a secure toe hold. I watched for over an hour from my portable blind while the hen wandered around under the tree calling to the nestlings and followed closely by the ducklings that had succeeded in joining her. She finally had to leave the five young in the nest. Seeking to prevent a repetition of this tragedy, I decided to cut a strip of old carpet to serve as a gangplank up to the exit hole when the next brood was ready to leave. On this occasion I watched from my blind until the duck left her brood for her morning rest flight. Then I climbed to the nest and fastened the strip of rug in place with three small tacks, each requiring only two or three light taps of a tack hammer. I immediately closed the lid and climbed down the ladder. As I removed the ladder, the first duckling appeared at the hole and jumped out. In a moment all 11 young were on the ground around me peeping loudly and scattering through the Lily-of-the-Valley foliage surrounding the tree. Very evidently the "freezing" reaction had broken down under the stress of the tack hammer blows on the box. The hen never found these scattered young.

#### DEPARTURE FROM THE NEST

Newly hatched Wood Ducks have tremendous vitality, stamina and physical agility as soon as the egg moisture has dried and they are able to stand on their own feet. The ducklings are never fed or watered while in the nest. For this reason and for the safety of the young from predators, the exodus from the nest takes place the day following hatching.

On the day the ducklings are to leave the nest, the duck takes her customary early morning rest flight, returning as usual and entering the nest to brood her young. If the weather is warm and bright she will prepare to take off her brood rather early. Under these conditions she waits until the sun is an hour or two old so that dew and ground dampness is pretty well gone. On rainy or very chilly days, she may wait several hours, or even half a day, before starting to move her young.

When she feels that conditions are right, she will appear in the entrance hole. At first, usually only her head and neck protrude. She remains motionless in this position for several minutes while she scans the landscape, presumably for signs of danger. If frightened by sight or sound of human beings, she drops back for 15 minutes, more or less, before looking out again. If the coast appears clear she usually will drop back anyway for a short period. This goes on for an indefinite time. If no danger appears it may be only half an hour before she is ready to call out her brood. On the other hand, I have waited from early morning until past noon on occasions when neighborhood activities disturbed the anxious mother. All during this period neither duck nor duckling makes a call that can be heard from a distance of 20 or 30 feet.

When, at last, she decides to bring out her young, she makes a call or cluck that is difficult to describe. "Kuk, kuk, kuk" is repeated softly either from the nest entrance or a nearby limb or from the ground near the base of the nest tree. At once the ducklings can be heard peeping from the interior of the box. Very soon the first baby will appear

at the hole, balancing there momentarily and sounding off with a staccato "pee, pee, pee, pee" repeated rapidly eight or ten times. Then, with tiny wings extended, the little fellow springs out to alight on the ground with a thump two or three feet from the base of the tree. If no obstruction is encountered in the drop, he strikes on his breast and is immediately on his feet. If he is deflected by a twig or other object in falling, he may strike the ground on his back or elsewhere and, in so doing, may be momentarily stunned. But, I have never seen a duckling injured to a point where he was unable, after a moment, to use his legs actively, in spite of the fact that many actually bounce several inches on striking the ground, particularly when short-cut grass has allowed the earth to bake rather hard in dry weather.

I have watched 15 or more broods leave their nest and have never seen any duckling reach the ground by any other means than jumping. In all but two instances the hen has been on the ground near the tree during the full time that the young were leaving the nest. In one case the hen sat on a limb nearby calling until three or four ducklings were out when she joined them on the ground. In another case, involving a single natural tree cavity which has a rather large opening, one duckling jumped from beside his mother as she gave her call to the brood before she dropped to the ground.

The length of time involved in the exodus from the nest varies with the ease with which the young can reach the entrance. There is practically no hesitation at the entrance as each one jumps. With the one natural cavity where the nest floor is only a few inches below the hole, I have seen a brood of a dozen jump out in one minute. Sometimes two were in the air simultaneously. In the case of the nest boxes, most broods will succeed in getting out in five to ten minutes.

While waiting for her brood to leave the nest, the female walks about nearby, followed by the young that have joined her, as closely as though they were her shadow. As each new arrival straightens up after his drop, he hears her call or sees her and hurries along to join up. If there is ground cover nearby, the hen will lead her young there to wait, sometimes leaving the cover to meet a new duckling and then returning again to cover.

If the mother is frightened during the exodus, she will leave at once with what ducklings she has, deserting those in the nest. It takes considerable pressure to make her leave her little group of young once they have joined her.

On numerous occasions I have noted that as soon as the last duckling has left the nest, the female immediately starts her brood on the trip to water. She probably knows when to leave because she no longer hears young peeping in the nest. In all the broods I have observed, the mother has only once returned to the nest after the first young has jumped.

I believe the strongest and most active ducklings are generally the first to jump. They, therefore, are the most valuable because they are most likely to survive the perils of infancy.

#### TRAVEL TO THE WATER

The period, starting when the hen calls the ducklings from the nest and extending to their arrival at the water, is the most dangerous and vulnerable period in the life of a Wood Duck. Losses during this usually short period are tremendous (table 5). Whole broods are sometimes lost and partial losses are very frequent. In my study area, the principal causes of these losses are human interference, tardiness in leaving the nest box, and failure to keep up with the mother and the main group. Under wild conditions, predation and the necessity of extremely long travel must also take their toll in lost ducklings.

To reach the river from my area two routes are available, one at each end of the property. The whole center portion of the bluff frontage is occupied by an old stone quarry which would involve a 30- or 40-foot vertical drop to the quarry shelf. The duck never leads her young over this section.

In travelling to the cover along the edge of the bluff, the female always leads her young along routes where the best concealment cover is afforded, never crossing open areas when a longer route through cover is available.

After the brood disappears in the dense vegetation at the top of the bluff, my next sight of them is usually when they reach the railroad. The short trip down is beset with many obstacles and difficulties in the form of dense growth of grey dogwood, box elder, annual and perennial weeds, grape tangles, brush piles and the steepness of the terrain

Table 5  
Ducklings Lost in Leaving the Nest and Moving to Water

Live ducklings in nest	Ducklings reaching water	Losses
10	7	3
11	—	11
11	—	11
11	10	1
13	7	6
15	14	1
14	9	5
18	17	1
11	6	5
14	14	—
10	10	—
11	11	—
13	11	2
13	12	1
14	—	14
<hr/>		
Totals 189	128	61
Per cent	67	33

itself. I descend the bluff at the end opposite the route taken by the duck. On reaching the tracks, I hide myself about 30 or 40 yards from where I expect them to cross. The brood makes the trip down in about five minutes which gives me just time to hide myself properly before their arrival.

On arrival at the railroad the behavior of the hens may vary considerably. Some hens lead their young out into the open and proceed to call the ducklings across the rails, one rail at a time. The young have no great trouble in jumping over the rails, perhaps failing a time or two, but soon getting over in good shape. Other females seem to doubt the ability of the young to climb the rails, or perhaps, they only fear the danger involved in crossing an open area. In such cases the group may travel quite a distance parallel to the track before crossing. In 1948, one hen led her young 200 yards along the track before she found a spot where the ballast between the ties was partly missing so that the ducklings could pass under both rails instead of jumping over.

Only twice have railroad trains or engines caused complications. Neither time were the young in process of crossing the rails as the train arrived. In one case the hen flushed as the train approached. In the other, the hen remained with her young allowing the engine and train to pass within eight feet. I know she and her brood were that close to

the train because the bluff bank, at this point, is so steep that the ducklings could not possibly climb up to move farther away. The hen and brood crossed the track after the train had gone.

Once the family successfully negotiates the crossing of the railway, they have only to travel a few yards to the river. If the stage of the water is fairly high, so that water extends back into the weeds and brush along the base of the railroad embankment, the observation period is over and the young are in relative safety. They can feed and hide with a fair degree of security.

If, however, the river has fallen so that even a narrow open shoreline of mud and bare rock is exposed between the cover and the water, the hen immediately attempts the crossing of the main river. The passing of pleasure craft or large barges frequently drives the group back to shore. One hen that had been forced back kept her brood hidden on the bank for over an hour while a fisherman ran his long trot line out in open water. When he left, the brood immediately reappeared and started their river crossing.

The river crossing seems a tremendous undertaking for young birds scarcely 24 hours old. The channel is a half mile wide and the current runs from two to three miles per hour. When starting the trip, the young group tightly behind the mother and some have appeared to me to engage their toes in her feathers so as to be towed along at times. Watching with binoculars, I have noticed that when one or more ducklings fell behind, the hen slowed her pace until the laggards caught up.

The young are able swimmers and can even dive under water if badly frightened. In travelling short distances, as during feeding, they may spread out or trail substantially behind the female, but in the case of a long forced swim, such as this river crossing, they stay close to the mother and may even cling to her as indicated above.

My estimate of the distance from the starting point to the point of arrival diagonally across the channel is three-quarters of a mile, as the crow flies, but due to the current, the hen quarters upstream making the actual water distance substantially greater. I have timed several broods on this swim and they all take about 20 minutes, an astonishing speed for such a long trip.

#### SUMMARY

The erection of nesting boxes in a residential area in Burlington, Iowa, attracted a colony of breeding Wood Ducks (*Aix sponsa*) whose nests were accessible for intensive study. Observations were made on 63 nests in the years 1943 to 1950.

Laying may begin as early as March 23, but most clutches were initiated in April. A few late clutches were initiated in late May and early June, and these are believed to represent second attempts. One egg a day normally is deposited by each female.

Normal clutches averaged 11.8 eggs, the earlier nests having larger clutches than those initiated late in the breeding season. Dump nests, in which more than one hen deposited eggs, frequently had larger clutches, but these were not usually incubated. When dump nests are included with normal nests, the average clutch was 14 eggs.

Incubation commences after the last egg in a clutch is laid. The incubation period was found to vary from 27 to 33 days, hatching occurring on the 30th day in a majority of cases.

Drakes attended the hen until the fourth week of incubation and a few continued until incubation was completed.

Of the 868 eggs laid in the 63 nests, 695 hatched. However, probably fewer than 500 ducklings reached the river bank. Of 189 ducklings observed after departure from the nest, 61 (33 per cent) failed to survive the trip from the nest to water. Under wild conditions, reproductive success might be even lower.

*Burlington, Iowa, June 15, 1951.*